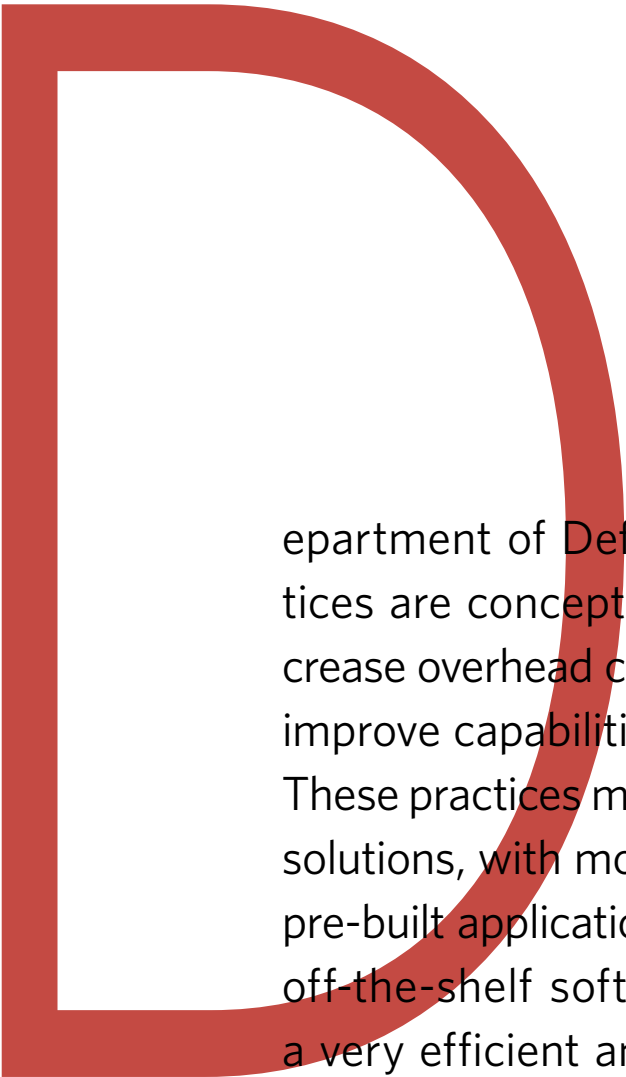


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Department of Defense acquisition practices are conceptually structured to decrease overhead costs while continuing to improve capabilities and interoperability. These practices mandate build versus buy solutions, with more emphasis on buying pre-built applications. Buying commercial off-the-shelf software—COTS—can be a very efficient and effective solution, if the context of the life cycle is considered in all customization decisions. If we are to achieve the expected gains from purchasing software versus building it ourselves, then for the entire life cycle of the product, we cannot allow any modifications. That is

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easily obtained in many small systems with a little discipline; however, large enterprise resource planning (ERP) solutions will encounter problems if not approached correctly from its initial acquisition phase. This article discusses the issues around COTS and business process reengineering, and improvements we can make to the acquisition process. First, let's examine the reasons a COTS purchase is usually a good choice by taking a look at the total cost of ownership and configuration control.

Total Cost of Ownership Advantage

The total cost of ownership begins with an estimate of all direct and indirect costs that might be associated with the acquisition life cycle. That involves making some assumptions about the future and then simulating various scenarios to arrive at alternative cost estimates. The goal of calculating the total cost of ownership is to support wise decisions about all the costs in the beginning and then anticipate and manage those costs during the life cycle. Changing to look at software acquisitions from a tactical view of the upfront and direct project costs to a total cost of ownership is a significant paradigm shift for DoD. The department must estimate the total cost of ownership against its strategic objectives—not from a budget concept. Many of the resources expended during a project are internal costs, so they are invisible in the budgeting process. The total cost of ownership for an unmodified ERP application versus a homegrown variety for a complex organization such as DoD is about 45 percent less than developing custom code. The greatest variances are in the time spent to upgrade and test the new modifications, and much of this is done by the software company in an unmodified ERP system scenario.

Each change, no matter how seemingly small, affects the ability to test and adapt future updates and software changes efficiently. Customizations are unique to the location. Quite often, this complicates the troubleshooting of a real bug in the software, as it is time-consuming to separate the real bug from the custom code. There are processes and procedures to address such a scenario, but they add additional time and cost that should be factored into the total cost of ownership. That's one reason why ERP systems rarely meet their scheduled delivery dates and never meet their expected return-on-investment objectives.

The figure "Cost of Change: Return on Investment" balances the number of features (software changes) against the anticipated return of that investment. As the number of changes in code increases, the increase is exponential and quickly erodes the return on investment. The cost of changing software is not linear, but exponential. Frederick Brooks, author of *The Mythical Man Month: Essays on Software Engineering*, attributes the exponential rise in costs of software changes to the cost of communication—costs to understand the software to be changed, the cost to understand what actually needs to be changed, the cost to com-

municate what needs to be tested, the cost to communicate what didn't work the way it was tested, and so on.

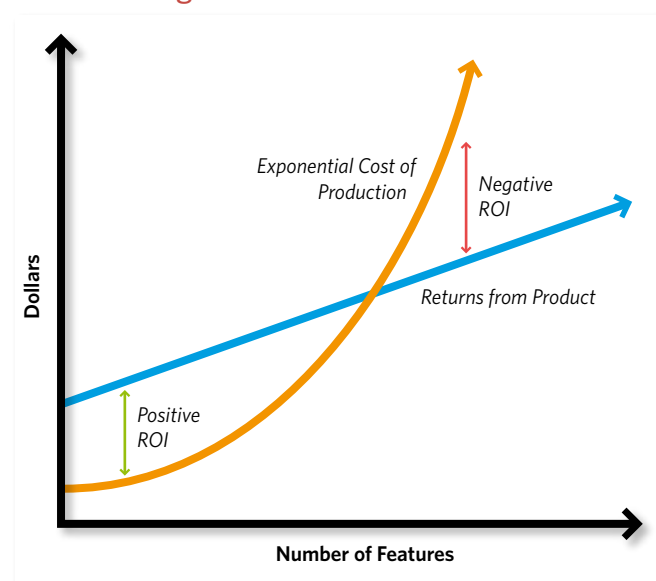
When the total cost of ownership is considered, the cost of a modified COTS can easily absorb any expected benefits or return on investment. In addition to the time (money) spent in modifying the software, the number of personnel saved by applying consolidated functionality via an ERP simply translates into more technical resources to maintain the software. Technical resources generally have higher costs because of the need to analyze, modify, and manage the software architecture.

Configuration and Change Control

The chief means for controlling the total cost of ownership is to minimize the number and degree of changes permitted to the baseline software. ERP packages are designed for a large audience of companies looking to achieve success by following a template of best business practices; however, software often fails to achieve its promise because of people's reluctance to change and their adherence to old processes. That leads to costly program modifications to replicate the old processes. That, in turn, can result in unnecessary manual tasks and software maintenance issues, which neutralize the original benefits of the software. Customization and subsequent upgrades are costly, and the decision to hold the line should be made at the beginning of the acquisition and revisited only under the most extreme circumstances.

According to Donald Burleson in his article "Selecting an ERP system: Build or buy?" (<http://articles.techrepublic.com.com/5100-10878_11-1040167.html>), "If your organization does not have a clear competitive advantage from your ordinary business systems, an off-the-shelf solution can offer the greatest benefit because a packaged solution can be used right out of the box and requires very little IT overhead."

Cost of Change: Return on Investment



In a keynote address in 2002 to the Third International Conference on Extreme Programming, Jim Johnson, chief executive office of the Standish Group, quoted a DuPont study that showed only 25 percent of systems features were really needed. "On average, 45 percent of software features are never used, and only 20 percent of features are used always or often," he said, giving us a frank reminder that we need to ensure the requirement meets a strategic need and doesn't simply pave an existing cowpath in the organization's processes.

ERP solutions are modular and flexible, and thus can be customized to a certain degree; however, major modifications are complex and extremely costly. Software packages—especially ERP software packages—have processes encoded into their click trails and transactions that will never do everything a customer wants. It is important to remind the integrated product team and those who are customizing software to modify the COTS package only where it is a strategic advantage. With that in mind, DoD would make very few customizations to an ERP system.

The trap for program managers is easy to fall into, though. Software companies, sponsors, and implementation teams are very willing to justify customization at what initially seems like a very low price to pay in comparison with the angst incurred when the program manager asks the organization to change. Regardless, it is still imperative for the organization to change its business processes to meet the COTS-embedded processes rather than customize the COTS to meet the organization's process.

Business Process Reengineering

According to a Feb. 12, 2010, memorandum from the Office of the Deputy Chief Management Officer and the Fiscal Year 2010 National Defense Authorization Act: "Section 1072 does not allow funds to be obligated for a defense business system modernization that will have a total cost in excess of \$1,000,000 unless appropriate BPR efforts have been undertaken. The business process to be supported by the defense business system modernization will be as streamlined and efficient as practicable."

A memorandum providing guidance on implementing the 2010 National Defense Authorization Act update to U.S. Code 222v4, "Implementation of Section 1072 of the Fiscal Year (FY) 2010 National Defense Authorization Act (NDAA)—Business Process Reengineering (BPR) Assertion," specifically states the BPR will be done during the requirements generation, which for most software development and acquisition life cycles is *before* the request for proposal is released. Implementing COTS business products, specifically ERPs, significantly affects the organization's culture, structure, and business processes in addition to its procedures and rules. Documenting business processes that you know will need to be modified significantly in the near future is not an effective use of one's resources. An efficient busi-

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ness process is one where the organization, process flow, and the configuration of the COTS system are done concurrently; and you can't do that until you know what software you are purchasing. V. Koch's article, "BPR and ERP: realizing a vision of process with IT," published in a 2001 edition of the *Journal of Computing and Information Technology*, further pressed the need to combine ERP implementations with BPR:

The implementation delays and ERP product modifications could result in exponential growth in both direct and indirect costs. ... It would always be better to complete the BPR project prior to information system modeling and ERP system development. Since the implementation of large information systems is not possible without first altering business processes, reengineering is essential in order to extract maximum benefit out of the ERP products. However, analysis of business practices shows a different approach. Initiating BPR projects prior to ERP means that the companies must provide resources for two successive projects. The reason why many companies chose to conduct ERP system development was to attempt to solve all their organizational problems without reengineering business processes first. ERP applications integrate many best business practices and much knowledge that could be worthwhile if included as a part of BPR projects. By taking the best practices inherent in ERP applications, companies can change their processes simultaneously with technological change. As a result, many companies changed their business processes to fit the ERP system requirements, and the possibilities of ERP systems have been used to underpin BPR.

Koch and the National Defense Authorization Act are accurate in stipulating BPR, but it should only occur in conjunction with the COTS implementation and not before it. If BPR is

not approached in this manner, the new business processes will require rework and will erode the cost benefits expected from the initial BPR.

Fine-Tuning the Program Strategy

Executive leadership must be visibly involved in executing strategy, and software implementation is no exception. Only leadership can quickly address the disagreements that arise in the process of transforming through BPR and an ERP implementation.

Rules need to be modified to take advantage of the evolutionary strategy an integrated BPR and COTS implementation requires. While it is very difficult for an integrated product team of subject matter experts familiar with their own processes to remain disassociated enough to effectively determine what needs to be changed, organizations can establish rules to evaluate each change to ensure it meets a strategic or competitive need.

ERP systems and implementation teams are experienced in delivering software all at once versus an incremental delivery; however, BPR and ERP can be delivered incrementally, prioritizing process and technical improvements by need, value, or other criteria. Such agile principles applied to an integrated BPR and ERP yield significant and early results.

So while we can decrease our long-term sustainment costs through the use of COTS purchases, we can do so only if we modify our processes to match those inherent in the software system. If we intend to do our part to decrease the deficient, our acquisition strategy and program management plan must incorporate that approach from initiation to better prepare the end users for the paradigm shift they will encounter. Furthermore, we need to market organizational change for the positive it is—the embracing of the software's processes and the resultant significant saving in sustainment costs. To do so, we need to close the gaps in our acquisition skill sets—specifically our skills in process engineering.

Incorporate DFSS into the Guidebook

The Defense Acquisition University *Defense Acquisition Guidebook* does not currently address the need to modify business

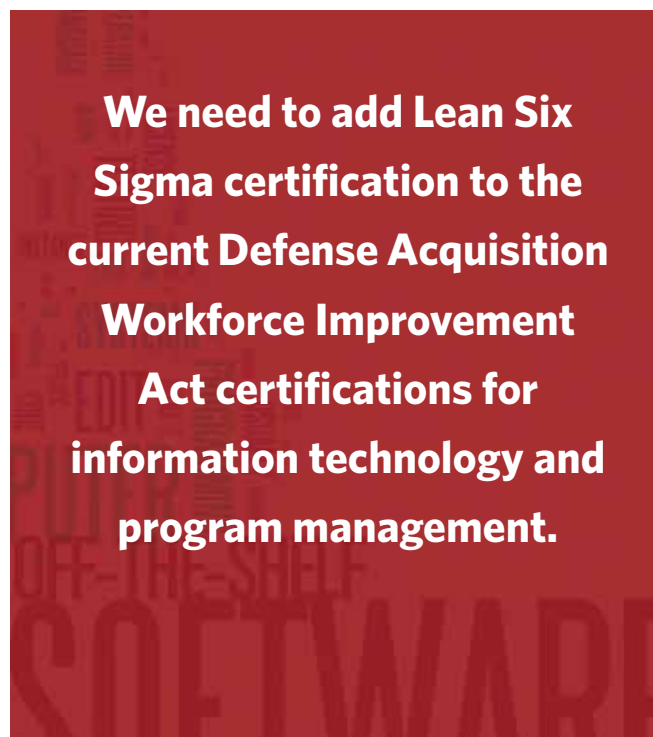
processes while implementing enterprise solutions. Its software engineering waterfall-esque approach to enterprise software acquisition needs to include the tasks related to assessing the organization and adapting the organization to the inherent software processes. Nor does the *Defense Acquisition Guidebook* address the need for business process reengineering in parallel with COTS implementation.

Once implemented, the value of ERP initiatives becomes embedded in processes that are difficult to quantify. COTS business software has embedded processes; therefore, if we do business process reengineering before purchasing software, we will have to redesign those processes to the ones inherent in the software functionality, and that can easily negate any gains resulting from reengineering or a COTS purchase. Merging BPR with agile principles of an iterative delivery and a trained team of technical and business experts will result in a program that is truly performance- and results-based.

Bring in Lean

In his book *Design for Six Sigma*, Subir Chowdhury states that changing a design after a product launch and not during the development state can cost a company a thousand times more. Extending this understanding that systems design includes human factors and processes, it is clear that our teams need the necessary skills to design these processes in their BPR efforts and major defense acquisition programs to be effective. One of the optional continuing education courses offered by DAU is Lean Manufacturing (CLB 007). The course touches on Six Sigma and provides familiarity with the terms. For more in-depth training, DoD has adopted Lean Six Sigma green and black belt certification programs. We need to add Lean Six Sigma certification to the current Defense Acquisition Workforce Improvement Act certifications for information technology and program management.

DoD 50000.01 requires acquisition teams to adopt innovative practices to reduce time, assuming that the teams have the skill sets in process improvement and transformation. It also drives program managers to reduce technology risk and states that the “acquisition of software



intensive systems shall use process improvement and performance measures.” But how many program managers and integrated product teams have the skills to frame their programs to maximize the benefits of adopting iterative delivery practices and process reengineering?

Sponsors, program managers, and the integrated product team members must be able to assess the technological and business process issues involved with specific ERP applications. It must be stressed that failing to match business processes with a company’s ERP system can derail even the best-run organizations. Managers and employees must be able to assess the technological and business process issues involved with specific ERP applications.

The military services’ Lean Six Sigma initiatives are perfectly aligned to be merged with our acquisition framework, with a few subtle tweaks. These initiatives embrace the classic DMAIC process—or define, measure, analyze, implement, and control phases—typically applied to continuous improvement. This view attacks root causes of existing processes. Design for Six Sigma (DFSS) attacks a company’s problems during the product and process development state. While the tools and order used in Six Sigma require a process to be in place and functioning, DFSS has the objective of determining the needs of customers and business, and driving those needs into the product solution so created. DFSS is relevant to the complex system/product development phase, especially in the context of a new system. It is process generation in contrast with process improvement. DFSS strives to generate a new process where none existed or where an existing process is deemed to be inadequate and in need of replacement. DFSS aims to create a process with the end in mind of optimally building the efficiencies of Six Sigma methodology into the process before implementation; traditional Six Sigma seeks for continuous improvement after a process already exists.

In conclusion, DoD 5000.01 and the Fiscal Year 2010 National Defense Authorization Act require process improvement and performance measures in concert with industry best practices, but stop short of delivering the value envisioned as they require business processes to be reengineered prior to the selection and purchase of a COTS business solution. The COTS technical solution will have built-in processes that will be expensive if not impossible to change. We must build business processes around the capabilities of the technology and not modify the technology. We must also train our program managers in Lean Six Sigma practices so they can effectively lead the team to achieve the most efficient and effective balance to execute our agency of tax payer dollars.

The author welcomes comments and questions and can be contacted at cindy.shelton.1@us.af.mil.

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